FCC CERTIFICATION TEST REPORT

for

Hetronic USA
4300 Highline Boulevard
Building A
Oklahoma City, OK 73108

FCC ID: LW9-CS 434

June 21, 2000

WLL PROJECT #: 5369X

TABLE OF CONTENTS

Tables

Exhibits

Appendices

FCC CERTIFICATION TEST REPORT

for

FCC ID: LW9-CS 434

1.0 Introduction

This report has been prepared on behalf of Hetronic USA to support the attached Application for Equipment Authorization. The test and application are submitted for a Periodic Intentional Radiator under Part 15.231 of the FCC Rules and Regulations. The Equipment Under Test was the Hetronic CS 434.

All measurements herein were performed according to the 1992 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and field Strength Instrumentation. Calibration checks are made periodically to verify proper performance of the measuring instrumentation.

All measurements are performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

All results reported herein relate only to the equipment tested. The measurement uncertainty of the data contained herein is ±2.3 dB. Refer to Appendix A for Statement of Measurement Uncertainty. This report shall not be used to claim product endorsement by NVLAP or any agency of the US Government.

1.1 Summary

The Hetronic USA CS 434 complies with the limits for a Periodic Intentional Radiator under Part 15.231 of the FCC Rules and Regulations.

2.0 Description of Equipment Under Test (EUT)

The Hetronic USA CS 434 (EUT) is a modular transmitter used for sending remote control signals. The module is battery powered and incorporated into a small clip-on housing which contains a push button for use as a remote E-STOP. The unit transmits for a 20ms period once the E-STOP button is depressed. Once the button is released the transmitter immediately ceases transmission. The CS 434 transmitter module employs a crystal-controlled PLL synthesizer and frequency modulation techniques to communicate with the CS 434-RX receiver module.

It should be noted that Hetronic USA is not marketing or selling the CS 434 as a modular transmitter. The module tested will be housed in an enclosure with a momentary push button. The label with FCC ID will be placed on the end product and be visible to the end user.

2.1 On-board Oscillators

The Hetronic USA CS 434 contains the following oscillators: 12.8 MHz

3.0 Test Configuration

To complete the test configuration required by the FCC, the transmitter was tested with the antenna laying flat on the test table (horizontal) and with the antenna in a vertical orientation. The transmitter module was tested outside of the enclosure as the final design for the housing was not available. All testing was performed at 12 VDC.

3.1 Testing Algorithm

The transmitter module was configured with a Hetronic USA test unit that supplies 12VDC power and a 2.4kHz test signal to modulate the transmission signal. The EUT was configured for continuous transmission. Measurements were made with the transmit antenna mounted both horizontally and vertically.

Worst case emissions are recorded in the data tables.

3.2 Radiated Emissions Testing

The EUT was placed on an 80 cm high 1 x 1.5 meters non-conductive motorized turntable for radiated testing on a 3 meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Biconical and log periodic broadband antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-1992. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The output from the antenna was connected, via a preamplifier, to the input of the spectrum analyzer. The detector function was set to quasi-peak or peak, as appropriate. The measurement bandwidth on the spectrum analyzer system was set to at least 120 kHz, with all post-detector filtering no less than 10 times the measurement bandwidth.

3.2.1 Radiated Data Reduction and Reporting

To convert the raw spectrum analyzer radiated data into a form that can be compared with the FCC limits, it is necessary to account for various calibration factors that are supplied with the antennas and other measurement accessories. These factors are grouped into a composite antenna factor (AFc) and are supplied in the AFc column of Table 1. The AFc in dB/m is algebraically added to the Spectrum Analyzer Voltage in dbμV to obtain the Radiated Electric Field in dBμV/m. This level is then compared with the FCC limit.

Example:

Spectrum Analyzer Voltage:	VdBμV
Composite Antenna Factor:	AFcdB/m
Electric Field:	EdBμV/m = VdBμV + AFcdB/m
To convert to linear units:	EμV/m = antilog (EdBμV/m/20)

Data is recorded in Table 1.

Table 1: FCC 15.231 3M Radiated Emissions Data

CLIENT: Hetronic
MODEL NO: CS 434
DATE: June 16 2000
FREQUENCY: 433.86 MHz
BY: Mike Violette
JOB #: 5369
CONFIGURATION: EUT and EUT Output Antenna placed "FLAT" on test table

Frequency MHz	Polarity H/V	Azimuth Degree	Antenna Height m	SA Level (QP/AVG) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB
433.86	H	215	1.5	42.8	19.4	62.2	1285.2	10994	-18.6
433.86	V	135	1.5	28.5	19.4	47.9	247.7	10994	-32.9
867.72	H	215	1.5	16.4	27.5	43.9	156.9	1099	-16.9
867.73	V	135	1.5	6.5	27.5	34.0	50.2	1099	-26.8
1301.58	H	115	1.0	43.2	-10.3	32.9	44.3	500	-21.1
1301.58	V	115	1.0	34.7	-10.3	24.4	16.6	500	-29.6
1735.44	H	115	1.0	35.5	-7.5	28.0	25.0	1099	-32.9
1735.44	V	115	1.0	34.2	-7.5	26.7	21.5	1099	-34.2
2169.30	H	115	1.0	33.3	-5.8	27.5	23.8	1099	-33.3
2169.30	V	115	1.0	33.3	-5.8	27.5	23.7	1099	-33.3
2603.16	H	115	1.0	32.7	-5.1	27.6	24.1	1099	-33.2
2603.16	V	115	1.0	35.5	-5.1	30.4	33.3	1099	-30.4
3037.02	H	115	1.0	34.7	-4.4	30.3	32.6	1099	-30.5
3037.02	V	115	1.0	34.3	-4.4	29.9	31.2	1099	-30.9
3470.88	H	115	1.0	33.3	-3.9	29.4	29.6	1099	-31.4
3470.88	V	115	1.0	34.3	-3.9	30.4	33.2	1099	-30.4
3904.74	H	115	1.0	32.5	-3.4	29.1	28.5	500	-24.9
3904.74	V	115	1.0	33.7	-3.4	30.3	32.8	500	-23.7
4338.60	H	115	1.0	32.2	-3.0	29.2	29.0	500	-24.7
4338.60	V	115	1.0	34.7	-3.0	31.7	38.7	500	-22.2

Note: Measurements above 1GHz are average levels.

Table 1 (Cont'd): FCC 15.231 3M Radiated Emissions Data

CLIENT: Hetronic
MODEL NO: CS 434
DATE: June 16 2000
FREQUENCY: 433.86 MHz
BY: Mike Violette
JOB #: 5369
CONFIGURATION: EUT and EUT Output Antenna placed VERTICAL on test table

Frequency MHz	Polarity H/V	Azimuth Degree	Antenna Height m	SA Level (QP/AVG) dBuV	AFc dB/m	E-Field dBuV/m	E-Field uV/m	Limit uV/m	Margin dB
433.86	H	215	1.5	35.1	19.4	54.5	529.6	10994	-26.3
433.86	V	215	1.0	40.4	19.4	59.8	975.0	10994	-21.0
867.72	H	215	1.5	1.2	27.5	28.7	27.3	1099	-32.1
867.72	V	135	1.0	11.3	27.5	38.8	87.2	1099	-22.0
1301.58	H	215	1.0	34.7	-10.3	24.4	16.6	500	-29.6
1301.58	V	215	1.0	38.7	-10.3	28.4	26.4	500	-25.6
1735.44	H	215	1.0	32.2	-7.5	24.7	17.1	1099	-36.2
1735.44	V	215	1.0	39.0	-7.5	31.5	37.4	1099	-29.4
2169.30	H	215	1.0	33.3	-5.8	27.5	23.7	1099	-33.3
2169.30	V	215	1.0	33.2	-5.8	27.4	23.4	1099	-33.4
2603.16	H	215	1.0	32.8	-5.1	27.7	24.4	1099	-33.1
2603.16	V	215	1.0	35.3	-5.1	30.2	32.5	1099	-30.6
3037.02	H	215	1.0	32.5	-4.4	28.1	25.3	1099	-32.7
3037.02	V	215	1.0	32.3	-4.4	27.9	24.8	1099	-32.9
3470.88	H	215	1.0	34.0	-3.9	30.1	32.1	1099	-30.7
3470.88	V	215	1.0	32.3	-3.9	28.4	26.4	1099	-32.4
3904.74	H	215	1.0	34.2	-3.4	30.8	34.7	500	-23.2
3904.74	V	215	1.0	33.0	-3.4	29.6	30.2	500	-24.4
4338.60	H	215	1.0	33.0	-3.0	30.0	31.8	500	-23.9
4338.60	V	215	1.0	33.5	-3.0	30.5	33.7	500	-23.4

Note: Measurements above 1GHz are average levels.

Table 2: System Under Test

FCC ID: LW9-CS 434

EUT: Hetronic USA; M/N: CS 434

Table 3: Interface Cables Used

The end unit contains no I/O cables, however, all interconnection cables used during testing were non-shielded.

Table 4: Measurement Equipment Used

The following equipment is used to perform measurements:

Hewlett-Packard Spectrum Analyzer: HP8564E

Hewlett-Packard Spectrum Analyzer: HP8568B

Hewlett-Packard Spectrum Analyzer: HP8593A

Hewlett-Packard Quasi-Peak Adapter: HP85650A

Hewlett-Packard Preselector: HP85685A

Hewlett-Packard Preamplifier: HP8449B

Antenna Research Associates, Inc. Biconical Log Periodic Antenna: LPB-2520A (Site 2)

Antenna Research Associates, Inc. Horn Antenna: DRG-118/A

Solar 50 Ω/50 μH Line Impedance Stabilization Network: 8012-50-R-24-BNC

Solar 50 Ω/50 μH Line Impedance Stabilization Network: 8028-50-TS-24-BNC

AH Systems, Inc. Portable Antenna Mast: AMS-4 (Site 2)

AH Systems, Inc. Motorized Turntable (Site 2)

RG-214 semi-rigid coaxial cable

RG-223 double-shielded coaxial cable

EXHIBIT 1

CARRIER BANDWIDTH DATA

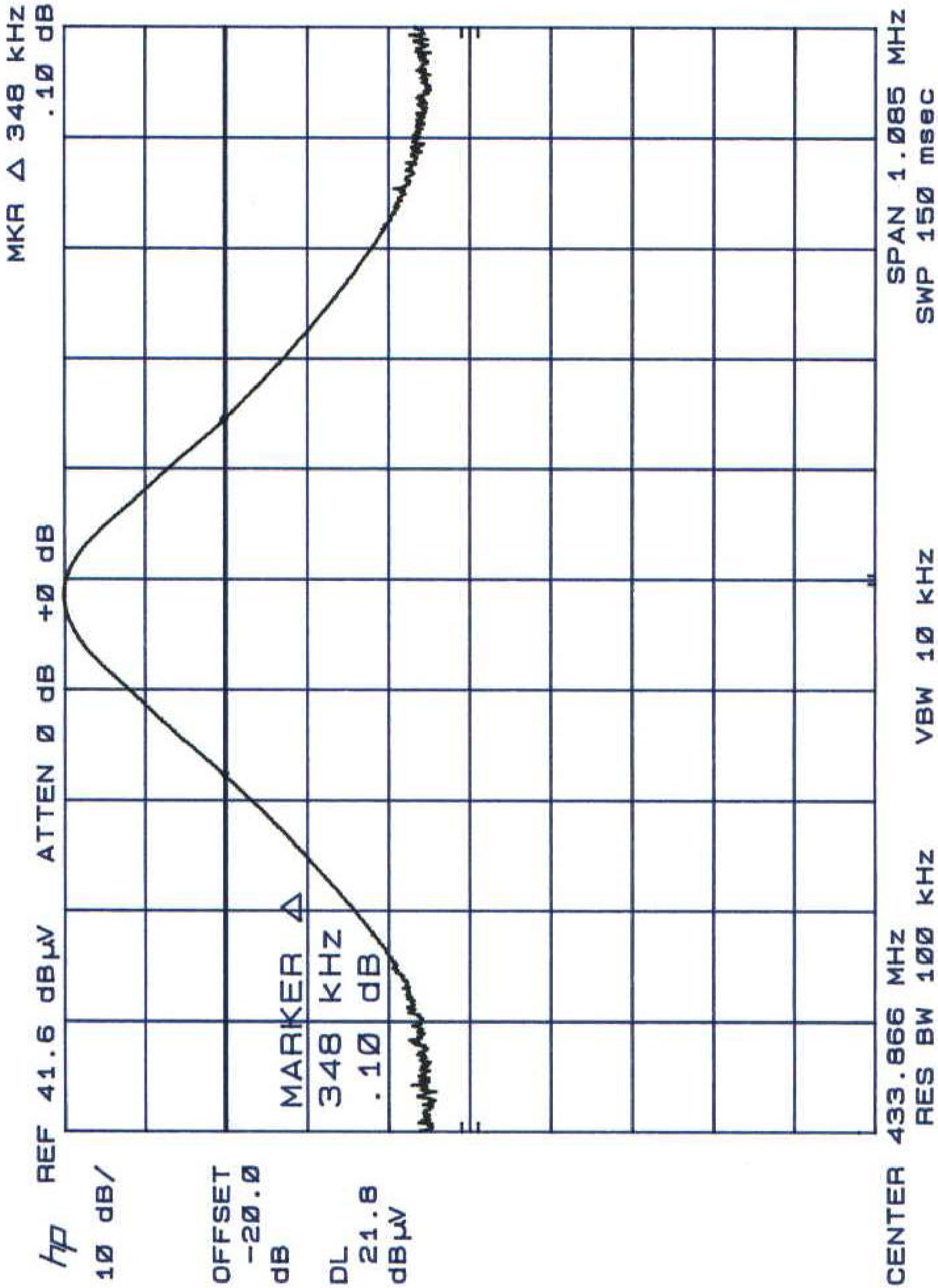
The 20 dB modulated bandwidth shall be no wider than 0.25% of the center frequency.

Bandwidth Limit = Carrier Frequency x .0025

Bandwidth Limit = 433.86 MHz x .0025 = 1.084 MHz

Measured EUT Bandwidth = 348 kHz

Bandwidth Plot



Appendix A

Statement of Measurement Uncertainty

For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.